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D1T

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(54) Device for injecting a substance into stranded elongate material

(57) A device for injecting a substance (e.g. a lubricant) into a rope (1), comprises a split sleeve (7) adapted to define a treatment chamber (8) around the rope, means (pipe 9) for supplying the substance to the chamber, and split sealing means (19, 20) surrounding the rope 1 at each end of the sleeve 7 for inhibiting the escape of the substance from the ends of the chamber. The sealing means (19, 20) at at least one end, and preferably at both ends, of the sleeve is rotatable relative to the sleeve, whereby the or each sealing means is able to rotate in response to any turning movement imparted to it by movement of the rope relative to the sleeve (arrow A). Two rotatable seals may be used at either chamber and (Figure 3, not shown), with leaking substance drained from between each pair of seals. The seals may be of polyurethane or butyl rubber.

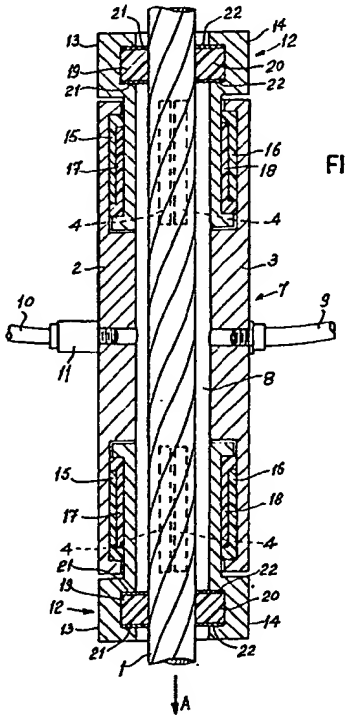

FIG.1

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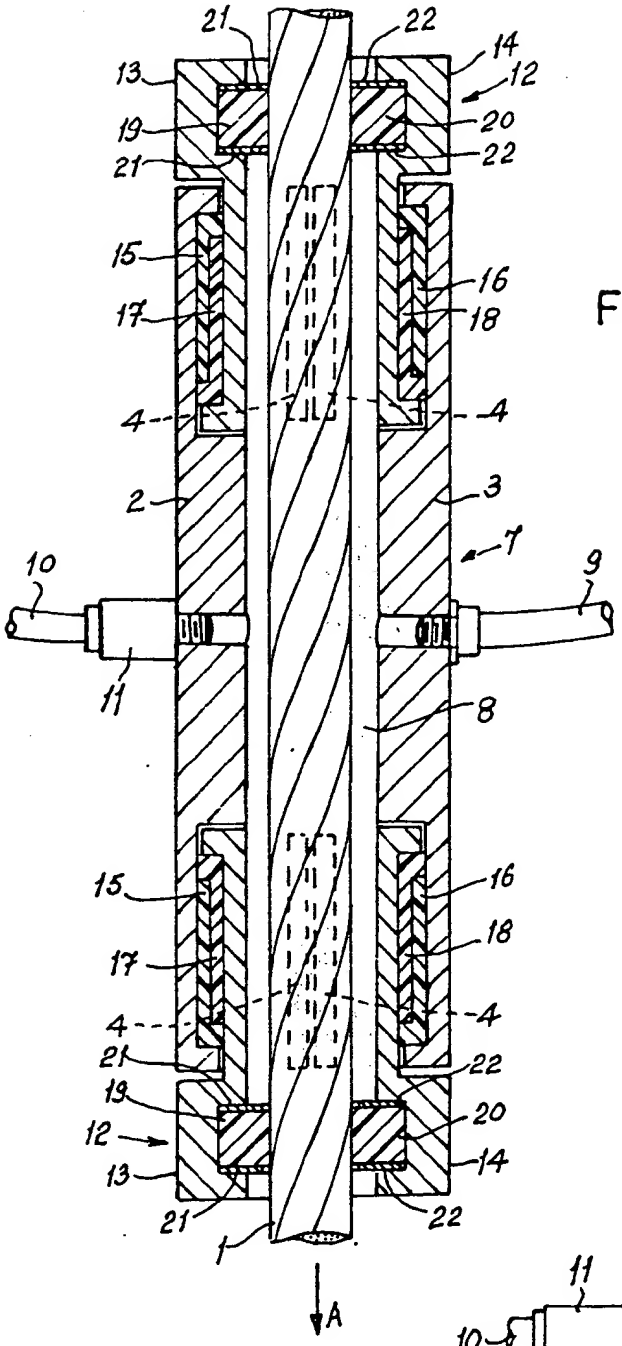
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9
11
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1
A

FIG.1

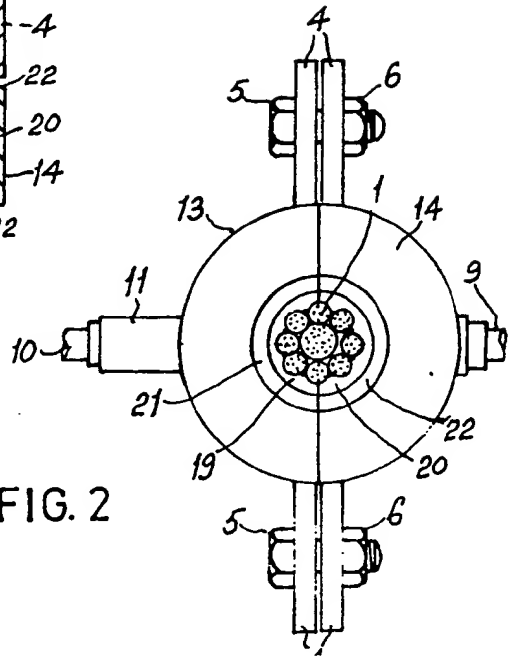
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FIG. 2

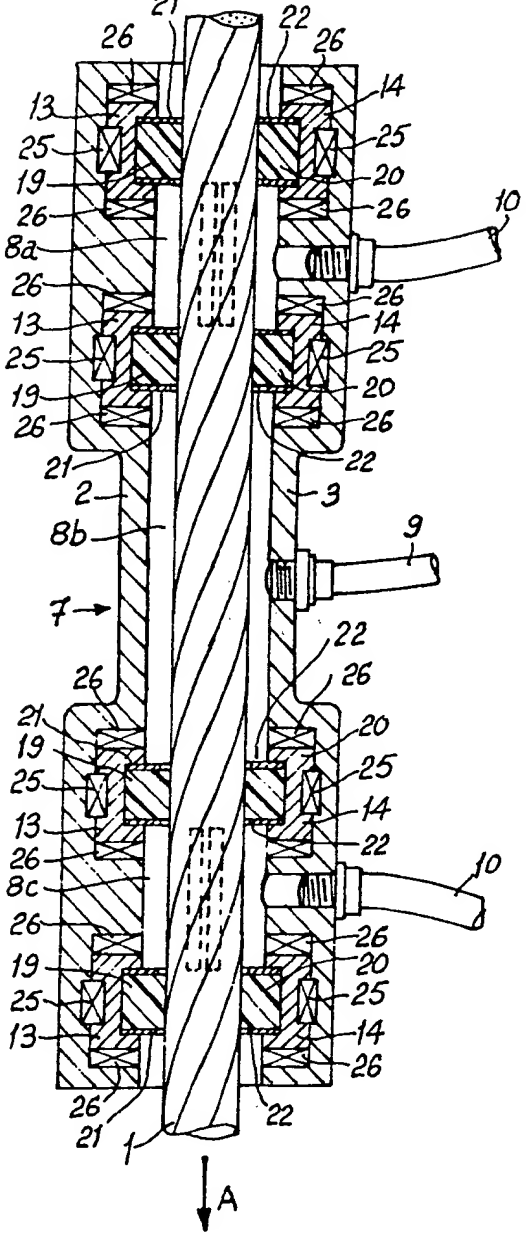

FIG. 3

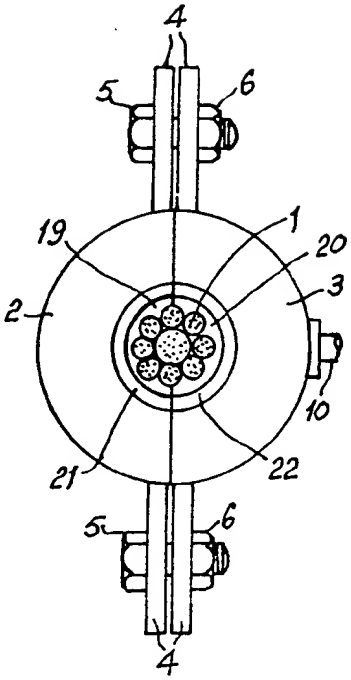

FIG. 4

SPECIFICATION

D vice for injecting lubricant or other treatment substance into stranded elongate mat rial

This invention relates to a device for injecting a treatment substance into stranded elongate material. Although the device is intended particularly for injecting a lubricating medium, which may have a liquid, semi-liquid, grease- like or thixotropic nature, into a stranded wire rope or cable, especially a steel rope or cable, it can be employed for injecting other treatment substances, for example anti-corrosion agents into stranded metallic material or preservative agents into stranded non-metallic material, for example hemp ropes. In order to simplify the ensuing description, the device according to the invention will be referred to as "a lubricating device", the treatment substance injected by the device will be referred to as "a lubricant" and the stranded elongate material with which the device is employed will be referred to as "rope".

Various rope lubricating devices are known. These consist essentially of a split sleeve which can be clamped around a rope to form a substantially closed annular chamber around the rope. Lubricant is supplied to this chamber and the rope is then drawn through the chamber (or in some circumstances the sleeve can be drawn along the rope). In earlier models of these known devices lubricant was supplied to the chamber at low pressure and this merely resulted in lubricant being smeared over the surface of the rope. These had the serious limitation that lubricant smeared on the surface of the rope serious limitation that lubricant smeared on the surface of the rope pene- penetrated only to a very limited extent and internal portions of the rope remained untreated.

More recent devices have attempted to overcome this limitation by pumping lubricant into the chamber under higher pressure, for example at a pressure of from 5 to 40 bars. To make this possible, the chamber of the lubricating device is provided with one or more split annular resilient seals at each end of the chamber. The purpose of these seals is to press tightly against the rope at the ends of the chamber, in order to prevent excessive leakage of the pressurised lubricant from the chamber whilst the rope is drawn through it. However, many of the ropes with which such devices are employed are made from a plurality of helically disposed strands, thus giving the rope a helically fluted outer surface with quite deep helical grooves between adjacent flutings. Since the lubricating device has to be restrained from rotation, because of the tubing required to feed the lubricant to the chamber, and since a rope which is being treated with the device is not usually able to rotate freely, the helically fluted surface of the rope tends to wear away the resilient seals quite rapidly, especially in the case of ropes of metallic material. Consequently, the seals quickly become incapable of resisting the pressure required to inject lubricant into the central portions of the rope. This condition few metresof the rope have been drawn through the lubricating device.

The present invention aims to provide a lubricating device for injecting a lubricant into a rope which does not have the disadvantages of the known devices described above.

According to the invention, a lubricating device (as hereinbefore defined) for injecting a lubricant (as hereinbefore defined) into a rope (as hereinbefore defined), which device comprises a sleeve adapted to surround the rope and define a treatment chamber around the rope, means for supplying the lubricant to the chamber, and sealing means surrounding the rope at each end of the sleeve for inhibiting the escape of the lubricant from the ends of the chamber, is characterised in that the sealing means at at least one end, and preferably at both ends, of the sleeve is rotatable relative to the sleeve, whereby the or each sealing means is able to rotate in response to any turning movement imparted to it by movement of the rope relative to the sleeve in the longitudinal direction of the latter.

Preferably, said at least one sealing means is made of a tough, resilient material, for example polyurethane or hard butyl rubber, so that when it is clamped around helically stranded rope, it tends to key into the helical grooves in the surface of the rope. As a result, when the rope moves through the sleeve of the device, said at least one sealing means is caused to rotate relative to the sleeve, so that there is no relative movement, in the circumferential direction of the sealing means, between the rope being treated and the sealing means. As a result, wear on said at least one sealing means is reduced to a minimum compared with that experienced with the fixed seals of the known lubricating devices.

Preferably, for ease of mounting the lubricating device on the rope to be treated, the sleeve is split longitudinally into two or more parts which are provided with interconnecting means enabling them to be clamped around the rope. Likewise, the sealing means at both ends of the sleeve are preferably split longitudinally into two or more parts. The parts of the sealing means may fit into the sleeve parts in such a way that the act of clamping the sleeve parts around the rope automatically results in the parts of the sealing means being clampled firmly around the rope. Alternatively, the parts of the sealing means may also be provided with interconnecting means enabling them to be clamped around the rope being treated independently of the sleeve parts.

Said at least one sealing means may be rotatably mounted directly in the sleeve. Alternatively, it may be mounted fixedly in a seal holder which is itself rotatably mounted in said sleeve. Pressure losses between rotatable and non-rotatable parts of the device are kept to the absolute minimum by manufacturing the parts to close tolerances and fitting suitable subsidiary seals where appropriate. Bearing, which again are preferably split longitudinally into two or more parts, may be provided be-

friction. Such bearings may be simple split journal bearings, for example made from nylon or other low friction material, or bearing surfaces may be machined on confronting surfaces of the rotating and non-rotating parts. In the case of heavy duty devices, split roller bearings and/or split thrust bearings may be used.

The device according to the invention may be provided with a single feed pipe for feeding the lubricant into the chamber of the device. In addition, one or more return pipes may be provided for returning surplus lubricant from the chamber to a supply container of the lubricant. In all cases, the pipe or pipes would be connected to a non-rotating part of the device.

The device according to the invention may be provided with a pressure relief valve in communication with the pressurised lubricant in said chamber. By setting the pressure relief valve at a particular level, for example 20 bars, and supplying lubricant to the chamber at a higher pressure, for example 25 bars, the pressure in the chamber can be maintained at said particular level. The lubricant discharged from the pressure relief valve may be returned to a supply container for the lubricant.

The invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a longitudinal sectional view of one embodiment of a rope lubricating device in accordance with the invention,

Figure 2 is a plan of the device of Figure 1, and

Figures 3 and*4* are views, similar to Figures 1 and 2, respectively, of a second embodiment of a rope lubricating device in accordance with the invention.

The lubricating device shown in Figures 1 and 2 is intended for injecting lubricant into a standard wire rope 1. The device comprises two semi-cylindri- cal sleeve parts 2, 3, each provided with two pairs of lugs 4 by means of which the two sleeve parts can be clamped together, employing bolts 5 and nuts 6, to provide a sleeve, generally designated by the numeral 7, around the rope. The sleeve 7 defines an annular chamber 8 around the rope 1. A pipe 9 connected to the sleeve part 3 serves to supply lubricant under pressure to the chamber 8. A pipe 10 connected to the sleeve part 2 serves to lead away surplus lubricant from the chamber 8 via a pressure relief valve 11.

At each of its ends, the sleeve 7 supports a seal holder, generally designated by the numeral 12. Each seal holder 12 is formed from two by the numeral 12. Each seal holder 12 is formed from two identical semi- cylindrical parts 13, 14, these holder parts being supported for rotation in the ends of the sleeve 7 by pairs of split bearing shells 15, 16 and 17, 18, respectively, made, for example, of nylon. At its axially outer end, each of the holder parts 13, 14 receives a seal in the form of a semi-cylindrical collar 19, 20, respectively, of hard butyly rubber, the axially facing surfaces of which are supported by semi-annular metallic plates 21, 22, respectively.

The above described lubricating device is assembled around the rope 1 in the following manner:

The semi-cylindrical collars 19, 20, each sandwiche between a pair of semi- annular plates 21, 22, respectively, are first mounted in their respective seal holder parts 13, 14. The pairs of bearing shells 15, 17 are then mounted in each end of the sleeve part 2 and the seal holder parts 13 are then placed in the assembled bearing shell parts 15,17 at each end of the sleeve part 2. In a similar way, the pairs of bearing shell parts 16, 18 are mounted in each end of the sleeve part 3 and the seal holder parts 14 are placed in the assembled bearing shell parts 16, 18 at each end of the sleeve part 3. The sleeve parts 2 and 3 are then placed around the rope 1 and the two parts clamped together by means of the bolts 5 and the nuts 6. The action of clamping the sleeve parts 2, 3 together causes the seal parts 19, 20 at each end of the sleeve 7 to encircle and firmly grip the rope 1.

In use of the device shown in Figures 1 and 2, lubricant under high pressure, for example 25 bars, is supplied to the chamber 8 via the pipe 9 and the relief valve 11 is set to discharge lubricant to the pipe 10 at a pressure of, for example, 20 bars. With the lubricating device held stationary, for example by means of an anchoring device (not shown) connected to one or more of the lugs 4, the rope 1 is drawn through the sleeve 7 in the direction of the arrow A. The helical strands of the rope 1 impart a turning moment to the seals 19, 20 at each end of the sleeve 7, with the result that the seal holders 12 rotate in the ends of the sleeve 7 in the bearings 15, 16, 17 and 18.

After prolonged use, the seals 19, 20 may become sufficiently worn to allow an excess of lubricant to leak past them. Failure of the pressure relief valve 11 to open can be a useful guide to such leakage taking place, indicating the need to replace the seals.

The above described lubricating device can be used with ropes of different diameters, it only being necessary to choose seals 19, 20 and support plates 21, 22 of suitable internal diameters for the rope being treated.

In the case of treating a rope 1 which is usually stationary, for example a mooring rope, the sleeve 7 can be moved along the rope 1.

The lubricating device shown in Figures 1 and 2 can be modified in various ways. For example, it may be necessary to combine the bearings 15, 16, 17, 18 with an auxiliary seal, for example a labyrinth type seal, to prevent leakage of lubricant around the outer surface of the seal holders.

Again, for some applications of the device, it may not be necessary to provide a rotatable sealing means at each end of the sleeve 7. For such applications, one of the seals 19, 20 would be replaced by a fixed seal of conventional design.

The lubricating device shown in Figures 3 and 4 is similar to that shown in Figures 1 and 2, and the same reference numerals have been used in Figures 3 and 4 to designate parts which are the same as, or similar to, the corresponding parts of the device of Figures 1 and 2. In Figures 3 and 4 there are two axially spaced-apart seals 19, 20 at each

end of the sleeve 7, which seals divide the annular chamber in the sleeve 7 into three sections 8*a*, 8*b*, and 8*c*.Each of the seals 19, 20 and their support plates 21, 22 are mounted in a split seal holder 13, 14 and the latter are supported in the sleeve 7 by means of split roller bearings 25 and split thrust bearings 26.

In use of the device shown in Figures 3 and 4, lubricant under pressure is supplied to the chamber section 8*b* via the pipe 9 and surplus lubricant leaking into the chamber sections 8*a* and 8*c* is removed via the pipes 10.

In a modified form of the device shown in Figures 3 and 4, the pairs of support plates 21 and 22 are joined by respective webs to form semicircular members of channel section in which the seal parts 19, 20, respectively, are mounted. It may then be possible to dispense with the separate seal holders 13, 14.

CLAIMS

1. A device for injecting a treatment substance into stranded elongate material, which device comprises a sleeve adapted to surround the stranded material and define a treatment chamber around the stranded material, means for supplying the treatment substance to the chamber, and sealing means surrounding the stranded material at each end of the sleeve for inhibiting the escape of the treatment substance from the ends of the chamber, characterised in that the sealing means at at least one end of the sleeve is rotatable relative to the sleeve, whereby the or each sealing means is able to rotate in response to any turning movement imparted to it by movement of the stranded material relative to the sleeve in the longitudinal direction of the latter.

2. A device according to claim 1, in which said at least one sealing means is made of a tough, resilient material which, when the sealing means is clamped around the stranded material, tends to key into the grooves in the surface of the stranded material.

3. A device according to claim 2, in which said at least one sealing means is made of polyurethane or hard butyl rubber.

4. A device according to any of the preceding claims, in which the sleeve is split longitudinally into two or more parts which are provided with interconnecting means enabling them to be clamped around the stranded material.

5. A device according to claim 4, in which the sealing means at both ends of the sleeve are split longitudinally into two or more parts.

6. A device according to claim 5, in which the parts of the sealing means fit into the sleeve parts in such a way that the act of clamping the sleeve parts around the stranded material automatically results in the parts of the sealing means being clamped firmly around the stranded material.

7. A device according to claim 5, in which the parts of the sealing means are provided with interconnecting means enabling them to be clamped sleeve parts.

8. A device according to any of the preceding claims, in which said at least one sealing means is rotatably mounted directly in the sleeve.

9. A device according to any of claims 1 to 7, in which said at least one sealing means is mounted fixedly in a seal holder which is itself rotatably mounted in said sleeve.

10. A device according to any of claims 1 to 7 and 9, in which bearings are provided between relatively rotatable parts of the device to reduce friction.

11. A device according to any of the preceding claims, comprising a single feed pipe for feeding the treatment substance into the chamber of the device.

12. A device according to claim 11, comprising one or more return pipes for returning surplus treatment substance from the chamber to a supply container of the treatment substance.

13. A device according to any of the preceding claims, comprising a pressure relief valve in communication with the treatment substance in said chamber.

14. A device for injecting a treatment substance into stranded elongate material, constructed and arranged substantially as herein described with reference to, and as illustrated in, Figures 1 and 2 or Figures 3 and 4 of the accompanying drawings.

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